

What is claimed is:

- 1           1.     A plasma etching apparatus comprising a chuck for retaining a substrate  
2     and hardware that includes oxygen therein such that said oxygen is released when an  
3     etching operation is carried out.
- 1           2.     The plasma etching apparatus as in claim 1, wherein said chuck is  
2     substantially circular and said hardware comprises a focus ring that peripherally  
3     surrounds said chuck.
- 1           3.     The plasma etching apparatus as in claim 1, wherein said chuck is  
2     substantially circular and said hardware comprises a focus ring that is annular in shape  
3     and at least a portion of said focus ring substantially continuously extends below a  
4     peripheral portion of said chuck.
- 1           4.     The plasma etching apparatus as in claim 1, wherein said chuck  
2     comprises an electrostatic chuck.
- 1           5.     The plasma etching apparatus as in claim 1, wherein said hardware  
2     comprises a focus ring composed primarily of quartz.
- 1           6.     The plasma etching apparatus as in claim 1, wherein said hardware  
2     comprises a focus ring formed of a ceramic.
- 1           7.     The plasma etching apparatus as in claim 2, further comprising a further  
2     focus ring, said focus ring and said further focus ring forming a focus ring set that  
3     peripherally surrounds said chuck.
- 1           8.     A plasma etching apparatus comprising a chuck for retaining a substrate  
2     and a focus ring, at least one of said chuck and said focus ring including oxygen therein  
3     such that said oxygen is released when an etching operation is carried out.

1           9.     A plasma etching apparatus comprising an etch chamber including therein  
2 a focus ring and a chuck for retaining a substrate, said focus ring maintainable at a  
3 temperature no greater than a temperature of said substrate while an etching operation  
4 is carried out upon said substrate.

1           10.    The plasma etching apparatus as in claim 9, wherein said chuck  
2 comprises an electrostatic chuck and said substrate comprises a semiconductor  
3 substrate.

1           11.    The plasma etching apparatus as in claim 9, wherein said focus ring  
2 maintains contact with said electrostatic chuck and said electrostatic chuck is cooled  
3 during said etching operation.

1           12.    The plasma etching apparatus as in claim 11, wherein said focus ring is  
2 disposed peripherally around said substrate and includes a portion that rests on an  
3 annular landing section of electrostatic chuck.

1           13.    The plasma etching apparatus as in claim 11, wherein said focus ring  
2 includes oxygen therein such that said oxygen is released during an etching process.

1           14.    A method for etching a semiconductor device on a substrate, comprising:  
2 providing an etching tool including therein a chuck for retaining a substrate and  
3 an oxygen-impregnated focus ring; and  
4 performing an etch operation such that said oxygen is liberated.

1           15.    The method as in claim 14, wherein said providing further includes  
2 providing a semiconductor substrate on said chuck and said etching operation includes  
3 a gas including  $C_xF_yH_z$ .

1 16. The method as in claim 14, wherein said providing includes providing a  
2 substrate on said chuck and further comprising cooling said substrate with a gas that  
3 includes oxygen.

1 17. The method as in claim 16, wherein said gas further include helium and  
2 said cooling comprises directing said gas through openings in said chuck.

1 18. A method for etching a substrate comprising:  
2 providing an etching apparatus including an etching chamber having therein a  
3 chuck for retaining a substrate and a focus ring;  
4 etching a film on a substrate disposed on said chuck; and  
5 maintaining said focus ring at a temperature no greater than a temperature of  
6 said substrate and maintaining at least a portion of said focus ring in contact with said  
7 chuck, during said etching.

1 19. The method as in claim 18, wherein said maintaining and said etching  
2 occur substantially simultaneously.

1 20. The method as in claim 18, in which said focus ring is formed of quartz  
2 and said chuck comprises an electrostatic chuck.

1 21. A method for etching a substrate comprising:  
2 providing a substrate on a chuck;  
3 etching said substrate ;  
4 generating an oxygen plasma and performing a clean operation while said  
5 substrate is on said chuck; and  
6 further generating a further oxygen plasma and performing a further clean  
7 operation while said substrate is positioned above said chuck or a further chuck.

1 22. The method as in claim 21, wherein said providing a substrate comprises  
2 providing a semiconductor substrate on a chuck, said semiconductor substrate including

3 a dielectric layer formed thereon, and said etching comprises etching said dielectric  
4 layer.

1 23. The method as in claim 21, wherein said generating and said further  
2 generating are performed in in-situ.

1 24. The method as in claim 21, wherein said etching includes using  $C_xF_yH_z$  as  
2 an etching gas.

1 25. The method as in claim 21, wherein said further generating includes said  
2 substrate spaced above said chuck by pins that extend above said chuck.

1 26. The method as in claim 22, wherein said dielectric layer includes a  
2 dielectric constant less than 3.2 and at least one of said first generating and said further  
3 generating includes a pressure less than 100 mT.

1 27. The method as in claim 22, wherein said dielectric layer includes a  
2 dielectric constant greater than 3.2 and at least one of said generating and said further  
3 generating includes a pressure greater than 50 mT.

1 28. A method for etching a semiconductor substrate comprising:  
2 providing an etching tool having an etch chamber including a semiconductor  
3 substrate disposed on a chuck and substantially peripherally surrounded by a focus ring  
4 that includes oxygen incorporated therein;  
5 performing an etching operation such that said oxygen is liberated;  
6 during said performing, maintaining said focus ring at a temperature no greater  
7 than a temperature of said semiconductor substrate and at least partially in contact with  
8 said chuck;  
9 after said performing, generating an oxygen plasma and cleaning said  
10 semiconductor substrate with said oxygen plasma while said semiconductor substrate  
11 is disposed on said chuck;

12 after said performing, generating a further oxygen plasma and further cleaning  
13 said semiconductor substrate with said further oxygen plasma while said semiconductor  
14 substrate is spaced over said chuck or a further chuck; and  
15 cooling by directing a mixture of helium and oxygen through openings formed in  
16 said chuck or said further chuck.